# PRELIMINARY OBSERVATIONS OF FISH ATTRACTION TO ARTIFICIAL MIDWATER STRUCTURES IN FRESHWATER

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*Abstract*: Midwater artificial structures were placed in a freshwater reservioir to determine if fish would associate with these structures. SCUBA observations were used to evaluate the effectiveness of the structures. Alabama spotted bass (*Micropterus punctulatus henshalli*) and bluegill sunfish (*Lepomis macrochirus*) were attracted to structures suspended over water depths up to 33 m and as far as 250 m from the shoreline. Behavioral observations of fish on structures and the development and subsequent association of spotted bass fry spawned on a structure are discussed.

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Many species of fish are known to associate with structures, natural or man-made, in marine, as well as freshwater environments. The association of fish with bottom structures, especially artificial reefs, has been well documented.

Recent work in the Gulf of Mexico demonstrated that pelagic fish associated with and concentrated around midwater artificial structures (Klima and Wickham 1971). Further research by Wickham, Watson, and Ogren (1973) demonstrated that midwater artificial structures could be utilized to improve the sport fisherman's catch. However, the effectiveness of these structures to concentrate pelagic species was found to be directly related to water clarity and availability of attractable fish.

Freshwater fishermen often refer to the position of sport fish in the water column as being "suspended". This term implies a distribution in the water column above a structure or substrate. The use of midwater attractor structures may provide a technique to improve the sport fisherman's catch by concentrating these open-water fish.

Properly deployed, midwater structures may be more advantageous than conventional artificial reefs because of their simple and relatively inexpensive construction, ease of transportation, and reduction of navigational hazards (Ogren 1974). In freshwater, especially storage and pump-storage reservoirs, midwater structures may have one other advantage. These reservoirs generally have great water level fluctuations that expose extensive bottom areas and reduce available structure and cover. Midwater attractors may provide added structure without adversely affecting the aesthetics of the exposed shoreline as would other man-made, reef materials, such as automobile tires.

If it were possible to attract and concentrate freshwater fish to structures placed in midwater, the sport fisherman's catch might be improved. Therefore, the purpose of this study was to determine if midwater structures could be used effectively to attract and concentrate sport fish in a freshwater storage reservoir.

## METHODS AND MATERIALS

Lewis Smith Reservoir is an 8,094 ha oligotrophic storage reservoir located in northwest Alabama. It is a deep, clear, steep-sided reservoir subject to water level fluctuations up to 9 m. A more complete description of the study area was presented by Webb and Reeves (1975). This specific study area was chosen because the water clarity would allow visual evaluation by SCUBA divers.

Each midwater structure was made of 2 plywood sheets (2.4 x 1.2 x 0.1 m) attached together in opposite planes and tethered on an anchor rope (Fig. 1). The sheets were notched through one-half the length and interlocked. For support, wooden braces were placed at alternate quadrants of each structure.

Two structures were suspended between a floating station buoy and a 48 kg weight attached to a 3.2 mm diameter aircraft cable to form an attractor unit. One structure, referred to in this discussion as the shallow structure, was positioned 5 m below the water surface. A second structure, the deep structure, was placed just above the thermo-

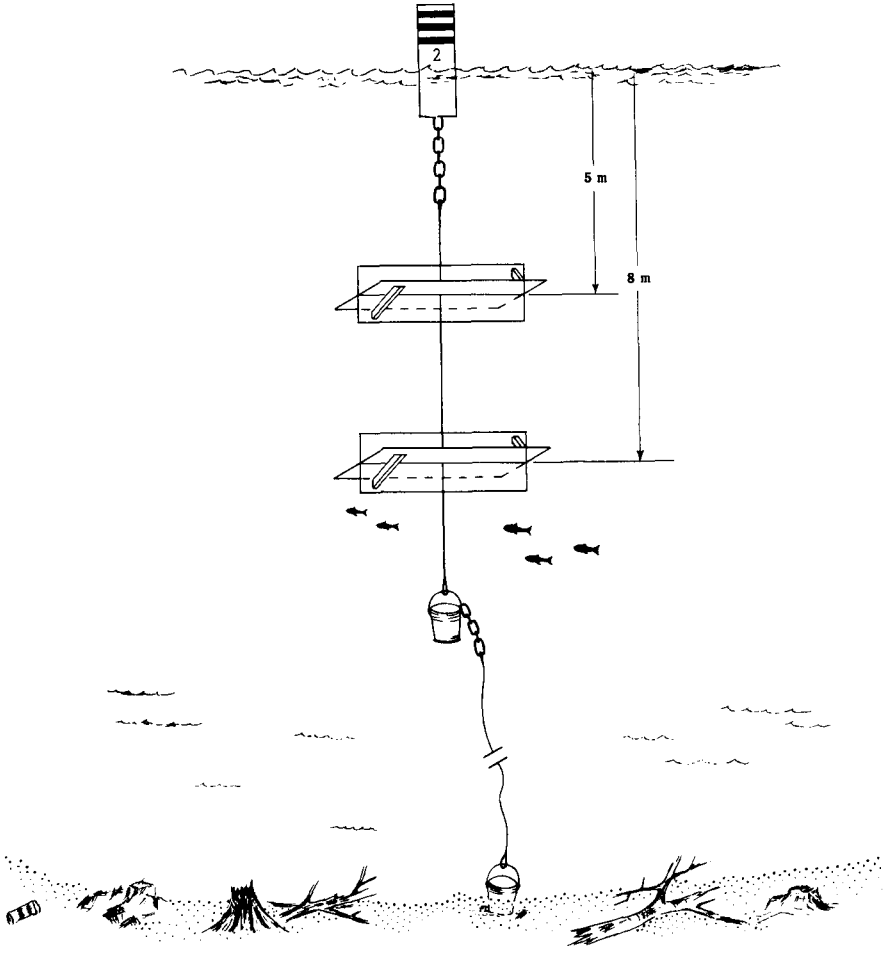


Fig. 1. Attractor unit design showing positions of shallow and deep structures.

cline, 8 m below the water surface. The attractor unit was tethered with sufficient polyethylene line to allow for normal reservoir water fluctuations.

Two units were placed in deep coves and 2 units were placed on long, deep points. This provided 2 replications (structures) for coves and points at both shallow and deep locations. All units were installed on 19 March 1976. Units in coves were anchored at a depth of approximately 33 m. Point units were anchored at a depth of approximately 21 m. Distance from shoreline to attractor units ranged from 50 to 250 m.

Diving observations were made biweekly beginning 6 April 1976 and concluding 28 December 1976. The study was originally designed for a 12 mo period; however, after 28 December 1976, low water temperatures and insufficient water clarity produced conditions that made diving observations difficult and unreliable.

Behavioral observations and estimates regarding numbers and sizes of fish species, water temperature, and visibility were made independently for each structure by at least 2 divers. All observations were recorded at the surface at the conclusion of each dive on an attractor unit.

## RESULTS

*Utilization of Structures*

The major sport fishes of Lewis Smith Reservoir include the Alabama spotted bass, bluegill sunfish, largemouth bass (*Micropterus salmoides*) and white crappie (*Pomoxis annularis*). Only 2 of these, the Alabama spotted bass and the bluegill, were observed on the midwater structures during the study period. The spotted bass observed ranged in total length from approximately 0.4 cm fry to 35 cm adult fish. The total length of bluegill ranged from approximately 1 cm to 25 cm.

Bluegill were observed in greater numbers than spotted bass. However, of the total number of bluegill, approximately 10,000 were fry observed on a single occasion. Spotted bass were observed more frequently on individual occasions than bluegill. Table 1 presents a chronologic summary of the total number of fish by species observed during the study period. For purposes of clarity, fish in the table were arbitrarily placed into size

Table 1. Chronologic summary of fish observed on midwater structures by size groupings within species.

| | *Species Observed* | | | | | |
|---|---|---|---|---|---|---|
| | *Spotted Bass* | | | *Bluegill* | | |
| *Date* | *Fry* | *Fingerlings* | *Adults* | *Fry* | *Fingerlings* | *Adults* |
| April 6 | --- | --- | 2 | --- | --- | 1 |
| April 14 | --- | --- | 2 | --- | --- | 1 |
| April 27 | --- | --- | --- | --- | --- | --- |
| May 11 | --- | --- | 2 | --- | --- | --- |
| May 26 | 500[a] | --- | 1 | --- | --- | 1 |
| June 8 | 400 | 5 | 4 | --- | --- | --- |
| June 24 | --- | 6 | 5 | --- | --- | --- |
| July 15 | --- | --- | 11 | 10,000 | --- | 4 |
| July 29 | --- | --- | --- | --- | --- | --- |
| August 10 | --- | --- | 1 | --- | --- | --- |
| August 27 | --- | --- | --- | --- | --- | --- |
| September 10 | --- | --- | 3 | --- | --- | 1 |
| September 21 | --- | --- | --- | --- | --- | 1 |
| October 5[b] | --- | 1 | 3 | --- | 1 | 1 |

[a]Eggs observed in nest.

[b]No fish observed after this date.

groupings of fry, fingerlings, and adults. Fish less than 25 mm were considered fry. Bluegill from 25 to 140 mm and spotted bass from 25 to 250 mm were termed fingerlings. Bluegill longer than 140 mm and spotted bass longer than 250 mm were considered adults.

Fish were observed on structures on 6 April 1976, 18 days after deployment of the attractor units. All size groupings of fish were seen in greatest abundance during the period from 8 June through 15 July 1976. Except on 3 occasions, fish were observed on 1 or more structures on every scheduled dive from 6 April through 5 October 1976. No fish were observed after 5 October 1976.

Because of great differences in the total numbers of fish within replications of cove and point units and generally low numbers of fish observed, valid comparisons between cove and point units and between shallow and deep structures for total number of fish could not be made. However, adult spotted bass tended to occur in greater numbers on shallow rather than deep structures (Table 2) and in greater numbers on points rather than coves (Table 3). Data on other groupings of fish did not exhibit any apparent relationships.

Water temperatures may have adversely affected the numbers of fish observed on deep structures. Since deep structures were placed just above the thermocline, water tempera-

Table 2. Comparison of shallow vs. deep structures for total numbers of fry, fingerling, and adult bluegill and spotted bass.

| Species Observed | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bluegill | | | | | | Spotted Bass | | | | | |
| Shallow | | | Deep | | | Shallow | | | Deep | | |
| Fy | Fg | Ad | Fy | Fg | Ad | Fy | Fg | Ad | Fy | Fg | Ad |
| 10 10,000[a] | 1 | 5 | 25 | 0 | 5 | 400[a] | 0 | 29 | 0 | 12 | 5 |

[a]Observed on one occasion only.

Table 3. Comparison of cove vs. point units for total numbers of fry, fingerling and adult bluegill and spotted bass.

| Species Observed | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bluegill | | | | | | Spotted Bass | | | | | |
| Cove | | | Points | | | Cove | | | Points | | |
| Fy | Fg | Ad | Fy | Fg | Ad | Fy | Fg | Ad | Fy | Fg | Ad |
| 25 10,000[a] | 2 | 2 | 10 | 0 | 8 | 400[a] | 0 | 7 | 0 | 11 | 27 |

[a]Observed on one occasion only.

tures at deep structures during most of the study period were lower than at shallow structures (Fig. 2).

The fright response of fish to the presence of divers may have affected the number of fish observed. On several occasions, adult fish were observed to flee from the vicinity of the structures as divers approached. There appeared to be a direct relationship between water clarity and ease of diver approach to fish around a structure. In clearer water fish within the divers' visual range could generally be observed easily without eliciting a fright response. But where water clarity was less than 3 m, a fright response was usually observed. During the study period, the visual range of the divers was often less than 3 m. Therefore, at times fish may have been present on the structures and never seen by the divers.

The general public was not informed that attractor structures lay below the station buoys in the lake. Therefore, a creel census was not used to evaluate the structures. However, after a few months into the project, fishermen were observed fishing over the structures. Those interviewed stated that they had caught spotted bass up to 0.9 kg and one stated that he had caught a white crappie that weighed approximately 0.5 kg.

*Behavioral Observations*

A spotted bass nest was found on 26 May 1976, on the shallow structure of a cove attractor unit. An area of approximately 45 cm in diameter had been swept clean of detritus and approximately 500 eggs were located within the nest. An estimated 1 percent of the eggs were dead. Viable eggs appeared to be in the late germ ring or early embryonic shield stage of development. Three days later all eggs had hatched, and the colorless larvae were concentrated within an area of approximately 15 cm diameter. By 5 June 1976, the fry had left the nest. All were approximately 1 cm in length. The school of fry swam in a spherical shaped mass approximately 0.6 m in diameter and located just above the horizontal plane on both sides of the structure. Fry were occasionally washed from the horizontal plane by currents created by diver movement. However, these fry would immediately return to the upper surface of the horizontal plane of the structure.

Fry no longer exhibited schooling behavior on 8 June 1976. They were evenly distributed over the upper surfaces of the structure and appeared to be more directly associated with the structure than with any schooling orientation. However, fewer fry appeared to be present than on the previous observation. Fry had reached an approximate

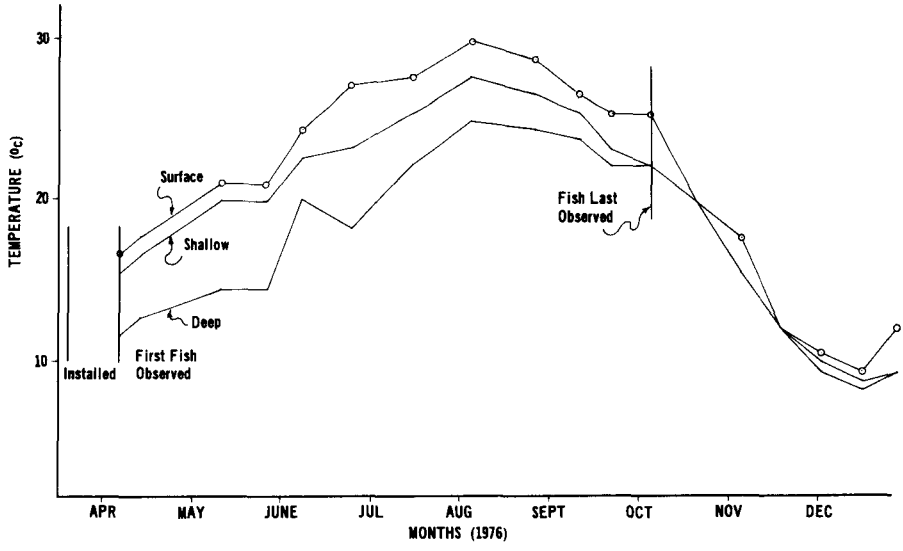


Fig. 2. Water temperature of surface, shallow, and deep structures from April through December 1976.

length of 2 cm by 14 June 1976. All were strong swimmers and exhibited directed movement above and below the horizontal plane of the structure. Fry associating with the underside of the horizontal plane, swam ventral side up. Those associating with the vertical surface below the horizontal plane swam ventral side laterally. However, fry swimming a few cm from the horizontal or vertical surfaces displayed normal orientation. Fry left the structure between 14 June and 24 June 1976.

An adult spotted bass (Ca 28 cm T.L.), assumed to be the brood male, was observed on each dive made to collect information on the eggs and fry. Initially, the fish remained on the periphery of the structure and would swim beyond the visual range of divers upon approach. After the eggs hatched, the brood male remained in close proximity to the structure and the nest. When divers closely investigated the nest, the fish would swim a circular pattern 2 to 3 m away from and above the structure. Just before the fry left the nest, the male remained very close to it. When divers approached to observe the fry, the male never retreated over 2 m from the nest and was never out of visual contact with the divers. The male assumed a more distant position after the fry left the nest and was only occasionally seen during observations of the fry. The brood male was not seen after the fry left the structure.

Fish were observed to establish a period of residence on only 2 occasions. On 6 April 1976 a mature male bluegill, approximately 19 cm in length, was observed at the shallow structure of a cove unit. This fish was believed to have remained at this structure for at least 8 days. On the 2 dives the fish was observed, it exhibited no fright response to the divers and actually approached divers and followed them from the shallow structure to the deep structure. A second residence period was established by the male spotted bass guarding the nest and fry. This fish remained on the structure for at least 19 days.

Feeding by fish on structures was observed for both species. Spotted bass fry produced from the spawn on the shallow structure were observed feeding on plankton in the water column on 2 separate occasions. Bluegill fry observed on 15 July 1976,

were "browsing" on periphyton on the structure and were also feeding on plankton in the water column. Adult bluegills were also observed feeding on the periphyton of the structures. No feeding was observed for the remaining size groupings of either species.

Information on spatial relationships of fish to the structures was collected. Spotted bass appeared to associate loosely with the structures tending to remain above the horizontal plane and around the periphery. Only occasionally were harvestable adult bass observed in close proximity to structures or below the horizontal plane. Spotted bass appeared to have been attracted directly to the structures since no feeding of adult spotted bass was observed and only rarely were small forage fish present when larger spotted bass were also present. Bluegill appeared to associate closely with the structures both above and below the horizontal plane. Observations of bluegill positioned within a few centimeters of a vertical or horizontal surface were not uncommon. The attraction of bluegill to structures appeared to have been a combination of feeding response and direct association with structures.

Total numbers of harvestable fish observed on structures in this study were low. However, midwater attractor structures possibly offer a technique to improve underwater structure in storage and pump storage reservoirs where water level fluctuations limit or prohibit the use of bottom artificial attractors. With improvements in design and placement of midwater structures, greater numbers and additional species of fish may be attracted.

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